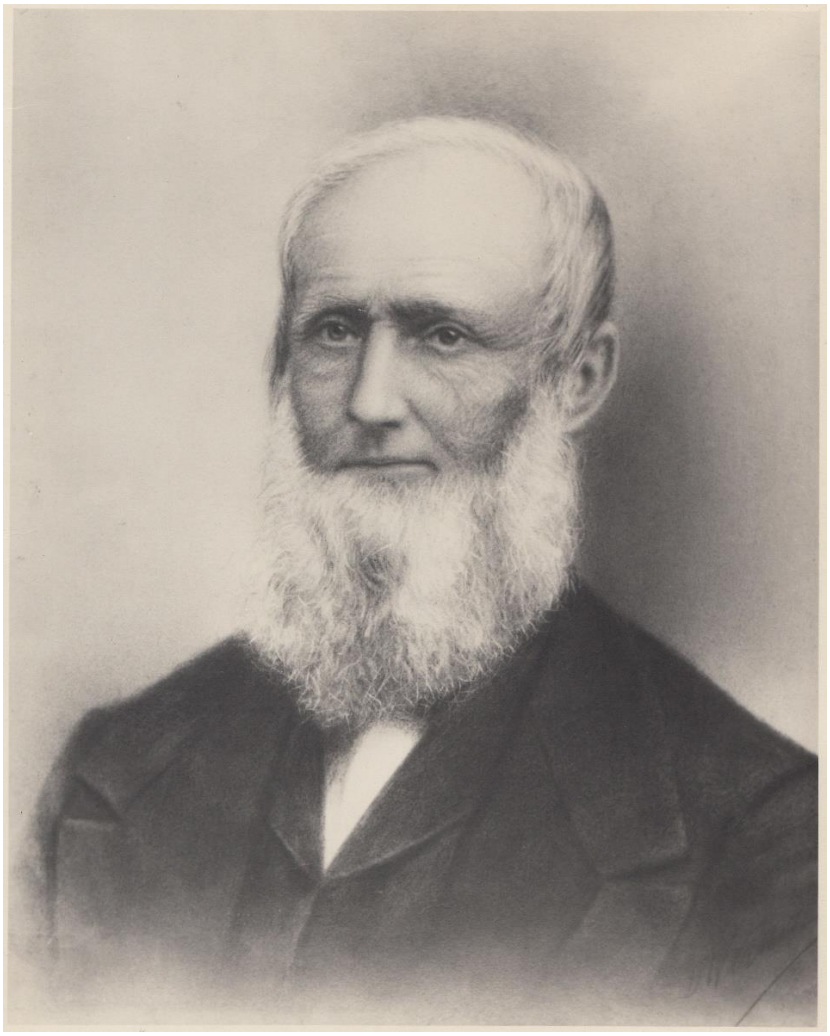
Building a Railroad in the Wilderness, 1827-1829

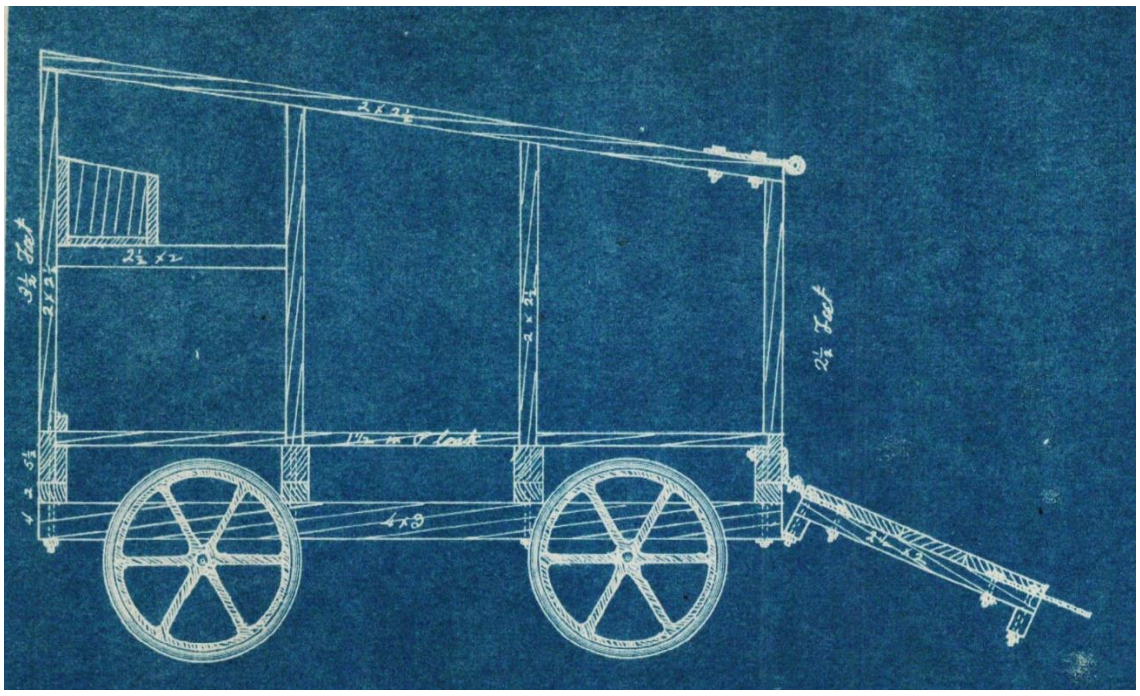
By S. Robert Powell, Ph.D.

"We have a virtually unlimited quantity of anthracite coal at our disposal. We have customers in New York who need our coal and who will buy it. To get our coal to market, we're now going to build a rail-road from Carbondale to Honesdale, where our coal will be loaded into canal boats and taken to New York. We have here all the lumber that we will need, and we have the manpower to build a rail-road to get our coal to Honesdale. Where and how do we begin?"



John B. Jervis, 1795-1885, designed and supervised the construction of five of America's earliest railroads, among which was the D&H Gravity Railroad (1829 configuration). Jervis also designed, in 1832, for the Mohawk & Hudson Railroad, the first locomotive with a swiveling 4-wheeled front bogie truck, the *Experiment.* With four of its six wheels mounted on a swiveling truck, the *Experiment* could reach speeds of up to 60 miles per hour.

Conduct a Survey, Propose a Route. On April 4, 1827, John B. Jervis, who was named Chief Engineer of the D&H on March 14, 1827, was directed to survey and locate a railroad from the proposed terminus of the canal, near Dyberry Forks, to the mines at Carbondale. On October 22, he presented a report, which was submitted to the Board of Directors on October 24. He recommended a double-rail railroad (a single track with a passing siding in the middle of each of the five inclined planes); timber rail capped by iron plates of rolled iron—not cast iron; five planes each having an ascent of from one hundred and twenty to two hundred and five feet, separated by short lines of levels of moderately declining road; chains not hemp ropes to pull the cars up the planes; five stationary steam engines at a cost, inclusive of the expense of procuring water, of $24,500 in all; for the descent from the summit to Honesdale and to retard motion on the three steep descending grades, he proposed a simple contrivance of sails so connected with the gearing as to hold the cars to a low and safe velocity; for the nearly level distances—about 11 miles—between the planes the use of seven steam locomotives of 6 or 7 tons was advocated; inclusive of railroad iron, bridges and machinery for stationary power, Jervis estimated the cost of the railroad would be $178,228.13; 320 railroad waggons would be needed to transport 540 tons of coal daily, and estimated the daily cost of operation as $159.32, a per ton cost of 29.5 cents or 1.8 cents per ton mile. Jervis concluded his report with these words: "Successful accomplishment will form a new era in the internal improvements of our country." [emphasis added] *(Century of Progress,* pp. 43-46)



Horse Cars were used on the Gravity Railroad, in the period 1829-1845, to move horses from the head to the foot of the levels between Waymart and Honesdale.

Manpower and Horsepower. "We need men who know how to work in the woods, and we need teams of horses, and we have both right here, in Carbondale." Work on the construction of the D&H Gravity Railroad was put under contract on November 25, 1827. The work was under the supervision of engineers John B. Mills (nine contractors and crews) and James Archbald (eleven contractors and crews). From *Ruth*, p. 17, we learn: "In all, 31 contractors and crews worked at building the railroad between March 1828 and June 1829." Account books show that six primary contractors used over 300,000 linear feet (more than 56 miles) of lumber in building trestles and tracks for the railroad. [John Torrey said that trestles supported about one-third of the length of the railway.] Another ten miles of beams were used as 'bracing.' Construction of the road was completed in June of 1829. The construction cost was $3 million.

Build Trestles. "We will construct the rail line, for the most part, through heavily forested land and over a mountain. As such, in order to minimize construction costs, there will be many trestles." On this question, Jason Torrey, in 1882, said the following: "A plan of construction was adopted, designed to accomplish the object sought, with as little outlay as practicable. As at least nine-tenths of the entire distance was through unbroken forests, where timber could be very cheaply obtained, all heavy embankments for grade were dispensed with, and as far as practicable, without too short curves, heavy excavations were avoided. When the grade was more than four feet above the natural surface, trestle work of timber was used, and in some parts where the grade was still nearer the surface, wooden posts were placed upright in holes dug in the earth three or four feet in depth, and broken stones filled in around the posts—the tops of the posts being sawn off at the proper height to receive the cross ties upon which the rails were to rest. In other cases where the grade was near the surface, the cross ties, which were usually ten feet distant from each other, were supported by stone piers under each end."

Use Wooden Rails and Strap Rails. Jason Torrey further noted: "Upon these cross ties were placed wooden rails of hemlock timber, generally six inches in thickness and twelve inches in height, and either twenty or thirty feet long, so as to extend across two or three of the spaces between the cross ties." The rails were made fast to the ties by wooden keys, or wedges, and in such position that the space between the rails should be just the width of the gauge adopted, which was four feet three inches.

"Where can we get the strap rails and other materials that we'll need to build this railroad?" In 1823, Horatio Allen graduated from Columbia University and was appointed Assistant Engineer of the Delaware and Hudson Canal Company. In 1827 he resigned from his position with the D&H and made it known that he was going to England to study there the emerging railroad technology, particularly locomotives. At that time, he was authorized by the Directors of the D&H and John Jervis to serve as the agent for the D&H while in England, and (1) to investigate the provision of three (possibly four) locomotives and to purchase one as a sample ("the locomotives are not to exceed four tons on four wheels and 6 tons to 7 tons on 6 wheels but a four wheeled locomotive is

preferable"), (2) to investigate chains for the inclined planes, (3) to source strap rail ("to be trapezoidal in section 2 ½ inches on the base and 2 inches on the top with ½ inch thickness; the top corners may have a radius of three-sixteenths of an inch unless this increases cost and time", and (4) to investigate and report on the management of wheels on the same axle and purchase samples.

Horatio Allen went to Great Britain. At Merthyr Tydfil in South Wales, he ordered made the strap rails for the rail line to Honesdale from Carbondale, but they were so poorly made that he refused to take them. He then went to Wolverhampton, England, and contracted with W. L. Sparrow of Temple Street, Wolverhampton, Staffordshire for 390 tons of rolled wrought iron strap rail: 15 ½ feet long, 2 ½ inches wide, and ½ inch thick. The D&H needed no less than 16 miles of strap rail for the 1829 configuration of the Gravity Railroad. If each piece of strap rail was 15 ½ feet long, the D&H would need, therefore, 5,451 strap rails to open the road on October 9, 1829. The strap rails ordered were then manufactured and shipped to America, where they were received on or before June 1828. (Strap rails were used on the D&H Gravity Railroad until 1858-1859, when they were replaced with standard T-Rails.)

The need for railroad iron in the northeastern United States continued to be strong well into the nineteenth century. On Tuesday, October 5, 1853, for example, 5,020 tons of railroad iron from England arrived in New York. In the *Carbondale Transcript & Lackawanna Journal*, October 7, 1853, p. 3, we read: : "RAILROAD IRON.—On Tuesday no less than eight vessels arrived at New York from England with cargoes of Railroad Iron, viz: Ship *Medallion,* 893 tons; ship *Amelia,* 845 tons; ship *Moro Castle,* 782 tons; ship *Champlain* 745 tons; barque *Florence,* 485 tons; barque *Gleanor,* 350 tons; barque *Rainbow,* 500 tons; and the barque *Austin,* 420 tons—making a total for the eight vessels of 5,020 tons".

Use Rolled Iron Rails. "Upon the top, and at the inner edge of these rails, flat bars of *[rolled* not *cast]* iron, two and half inches wide and half an inch thick, were laid and made fast by large screws through holes for that purpose in the iron bars. After a little experience the hemlock rail was found to be too soft for a firm bed for the iron bars, and strips of beech [or oak] 1 ½ to 2 inches thick and three to four inches wide were spiked to the top of the hemlock rail, and the iron bars fastened upon these beech strips. After a very little time the use of screws to fasten the iron bars was discontinued, and iron spikes used instead." *(Torrey,* 1882)

These strap rails were punched with slotted holes countersunk for the heads of the screws with which they were to be fastened to the wooden rails and the upper corners of the bars were rounded in rolling to a quarter circle having a radius of three-sixteenths of an inch. One end of each bar was finished with a tongue five-eighths of an inch wide and three-fourths of an inch long which fitted into an equivalent recess in the adjoining end of the next bar. [Using strap rails, as most railroaders know, is problematical, because their ends can curl up and form "snake heads" which can pierce the floor of a rail car.]

Stationary Steam Engines Will Power the Planes. Five stationary steam engines were purchased by the D&H from Messrs. Abeel & Dunscomb* (375 Water Street, New York) and installed on Planes Nos. 1-5, and were ready to go when the line opened. Horsepower of these five engines: Plane No. 1, 30 hp.; Plane No. 2, 35 hp.; Plane No. 3, 35 hp.; Plane No. 4, 25 hp.; Plane No. 5, 35 hp. In his letter of February 5, 1847, to President John Wurts, James Archbald reported that the engines on Planes Nos. 1-5 "have all been increased in power and are to be still further increased this [1847] winter."(The stationary steam engines that were needed by the D&H in the period 1845-1857 were purchased from the William Bourdon Foundry, 102 Front Street, Brooklyn, NY; the stationary steam engines that were needed by the D&H from 1857 on were purchased from the Dickson Manufacturing Company, Scranton—from whom the D&H bought sixteen 75-horse power engines in 1857. The several waterwheels that were used to power various D&H inclined planes in the period 1845-1868 were all made locally.)

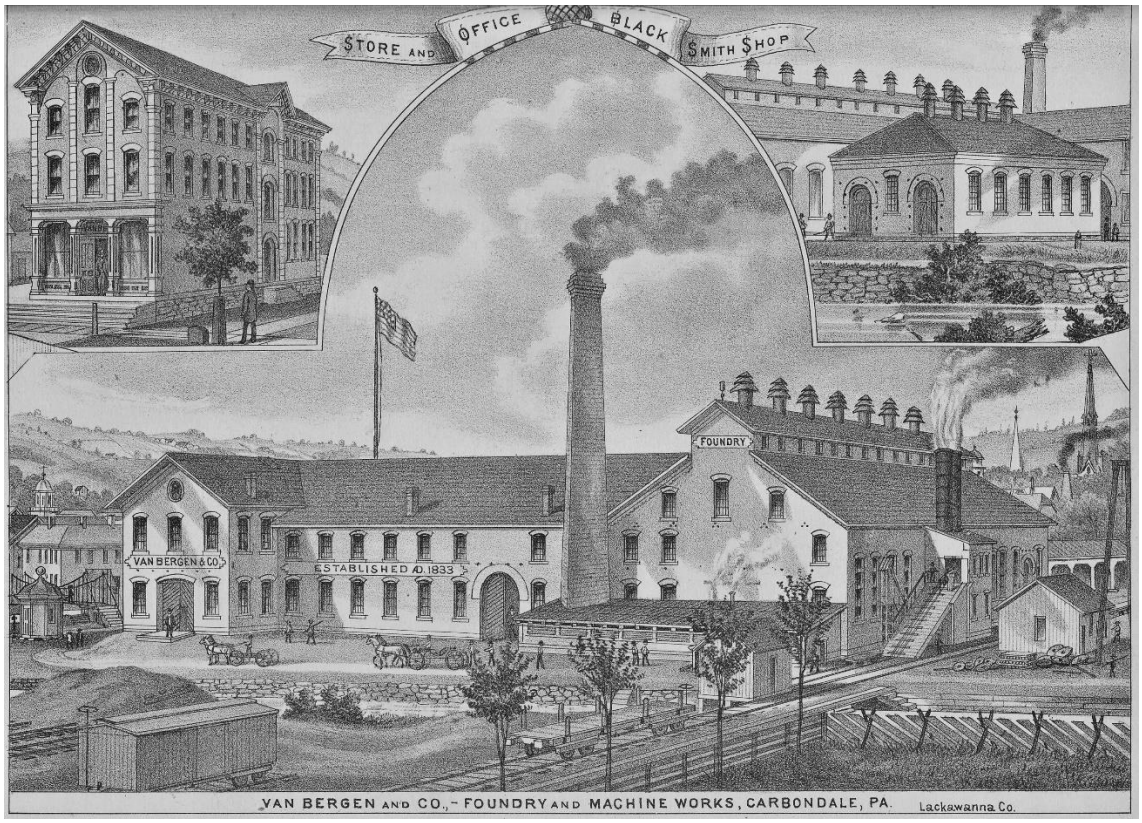
Use Chains to Move the Cars on the Planes. "Where can we get chains?" In addition to procuring the necessary strap rail needed by the D&H in order to construct its Gravity Railroad, Horatio Allen also purchased in England for the D&H the chains that were needed to pull Gravity coal cars up and then lower them down the eight planes in the 1829 configuration of the line. (Chains were used for that purpose only from October 9 to the end of the 1829 shipping season. The chains broke repeatedly. When the Gravity Railroad opened in 1830 hemp ropes were in place on the planes. They were used successfully until the 1859 configuration of the Gravity line was installed and the hemp ropes were replaced with Roebling's wire rope, (1 ¼ inches in diameter; initially made of iron, later made of low-carbon steel.)

Lowering the Cars on Planes Nos. 6, 7, and 8 Will Be a Complicated Process. John Jervis had a plan for braking on the down planes: "His [John Jervis] ingenuity was particularly apparent in his devising of a supplemental braking system for use on inclined planes. A trip of loaded cars would already be slowed somewhat in its descent because the chain to which it was attached would run up to a pair of large drums on the stationary steam engine, and around the drums several times (in the fashion of a double-pulley), then back down the incline where it would be attached to a trip of empty cars. As the loaded cars descended, their weight would pull the empty cars up the plane, and the resistance supplied by the empty cars would partly check the fall of the loaded cars. To slow them more, Jervis designed what he called a 'pneumatic convoy'. Descriptions of this device vary, but most sources agree that it amounted to a 12-foot fan with eight blades, standing upright, geared to one of the stationary steam engine drums so that as the drum turned, it turned the fan at an even faster rate. As air resistance had a braking effect on the fan's moving blades, the effect was transferred to the drum, then to the chain wrapped around it, and ultimately to the descending coal cars. For good measure, Jervis also instructed that at least one coal car in each trip be equipped with a conventional friction brake." (*Ruth*, p. 13)

Line the Fire Boxes with Fire Bricks. "Where can we get fire bricks" In the collection of the Carbondale D&H Transportation Museum there are fire bricks that are marked "RUFFORD / STOURBRIDGE". These bricks, which were used to line the interior of the fire chamber of each

of the stationary steam engines on the Gravity Railroad, were found by John V. Buberniak at the head of Plane No. 7 on the Gravity Railroad. It is not yet known when the D&H began to line the fire chambers of the stationary engines with these Rufford bricks. Possibly Horatio Allen ordered Rufford bricks for the D&H during his trip to England? Possibly the D&H began using Rufford bricks at a later date? In any event, these Rufford bricks were made in Stourbridge, England, and were imported to America and used in the engine houses on the D&H Gravity Railroad, most probably from 1829 on.

Rufford fire clay, it should be noted, has a world-wide reputation, and its importance in the manufacture of fire-bricks, glasshouse pots, and a variety of other purposes in connection with the industrial arts is well known. Its chief value consists in its refractory character, which enables it to resist the highest temperatures without melting. As many as forty million fire bricks are produced annually in Rufford.



Van Bergen & Co. Foundry, Carbondale. From 1833 on, all of the wheels and metal components of D&H freight and passenger cars made in Carbondale were made in the Van Bergen Foundry. The Van Bergen building shown in the upper left corner of this engraving still stands today. The building, with gray stone lintels and sills, is 100 feet long, 28 feet wide, and three stories high. The Van Bergen company offices and show rooms were in this building.

Make Coal "Waggons" of Wood. Up to 1833, there was not a foundry in Carbondale that could produce wheels for Gravity coal "waggons"—which meant that the wheels needed either had to be purchased in New York or imported from England. From 1833 on, all wheels for Gravity cars were made in Carbondale. In *Hitchcock,* Volume II, p. 329, we read: "The first foundry [in Carbondale] was established in the village in 1833 by Alanson Reed, a Methodist preacher, and Abiran Guernsey, proprietors. It was located on Church and Foundry Streets, and was principally employed in casting wheels for the Delaware & Hudson cars. Reed & Guernsey dissolved partnership February 14, 1834, the firm becoming Eggleston & Reed, William Eggleston having purchased an interest. Later the firm became Eggleston & Wilbur, who in August, 1837, sold to Pierson & Co., who operated the foundry as the Luzerne County Stove Foundry. Later the firm became Pierson & Benjamin, T. Benjamin & Co., and on April 3, 1873, J. B. Van Bergen & Co." (Initially, there were 275 coal waggons, each with a capacity of 2 ½ tons on the Gravity Railroad. When the road closed in 1899, there were on the line 4,600 coal cars, each with a capacity of 5 tons, and each with 8 wheels and link and pin couplers.)

Use Steam Locomotives on the Levels. "Where can we get steam locomotives?" Horatio Allen also ordered locomotives for the D&H while he was in England. Throughout his life, Horatio Allen said that he ordered three engines for the D&H. Others have said that he ordered four. Much has been written on this question and we will not focus here on that question.

Remarkably, less than two years after construction began, in March 1828, the D&H Gravity Railroad from Carbondale to Honesdale opened for business.

And so, a body of determined and talented men, guided by intelligent engineers and enlightened leaders and managers with a plan, built a railroad in the wilderness to transport millions of tons of anthracite coal from the Lackawanna and Wyoming Valleys in northeastern Pennsylvania to a canal in Honesdale. It was an astonishing engineering achievement. On Friday, October 9, 1829, there surely must have been more than a few of the builders of that rail line in the crowd at the foot of Plane No. 1 in Carbondale who, bursting with pride and with broad smiles on their faces, watched come alive the railroad that they had built in the wilderness.

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*Abeel & Dunscomb's foundry not only supplied the D&H with stationary steam engines for the 1829 configuration of the line, but also served as a demonstration venue for one of the first two locomotives that were imported from England by the D&H. In Philip Hone's diary for Wednesday, May 27, 1829, we read: "I went to Abeel & Dunscomb's foundry to meet a large party of gentlemen, who had assembled by invitation to see one of the new locomotive engines in operation, which was recently imported from England for the use of the Delaware & Hudson Canal Company, and which had been temporarily fitted under the direction of Abeel & Dunscomb. Among the visitors were the lieutenant-governor, chancellor, attorney-general, judges, senators, members of

Assembly, and many friends of the undertaking. / The second locomotive steam engine which was imported for the Delaware & Hudson Canal Company was set in operation this afternoon at the works of Messrs. Kemble, in the presence of a large party of gentlemen, and succeeded as well as the one I saw yesterday at Abeel & Dunscomb's."

Garret B. Abeel was a major figure in the early history of the D&H. On January 7, 1825, subscription books were opened for the purpose of receiving subscriptions to the stock of the D&H at the Tontine Coffee House in New York, Kingston (Middle District Branch Bank), and Goshen (Orange County Bank). The notice announcing the opening of the subscription books is dated December 2, 1824, and is signed by Philip Hone, Lynde Catlin, Jonathan Thompson, and G. B. Abeel. On March 8, 1825, Garret B. Abeel was elected one of the Managers of the D&H.

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